Eugene, Oregon
Community Greenhouse Gas Inventory
Calendar Year 2019

Report prepared by Good Company, December 2020

INTRODUCTION

This greenhouse gas (GHG) inventory quantifies the GHG emissions associated with the geographic boundary of a Eugene, Oregon in calendar year 2019. The City of Eugene conducts inventories at regular intervals so that community members can understand trends and manage emissions from specific sources and activities. The results of Eugene's GHG inventories are being used to support the Eugene community's Climate Action Plan (CAP2.0) work and provides the foundation for a GHG emissions tracking and management system related to the City's Climate Recovery Ordinance.

FINDINGS IN BRIEF

- **Sector-based Greenhouse Gas Emissions (local emissions)**[1]
    - Eugene's 2019 sector-based GHG emissions total just over **1 million MT CO_2e**.[2,3] The largest sources of community emissions include passenger and freight transportation (32%) followed by commercial energy (13%) and residential energy use (7%). See pages 5 and 7 for more details.
    - Eugene's sector-based GHG emissions have decreased by 4% since 2010.
    - On a per capita basis, emissions have declined by 12%, while total population has increased by 10%.
    - New opportunities for data collection provide a more comprehensive view of community emissions, and now include airport fuel use as an information only item. This is not part of the boundary used for CRO progress and is not required by GHG protocol. Emissions from airport fuel are roughly equal to 12% of all ground transportation.
- **Consumption-based Greenhouse Gas Emissions (local emissions + imported emissions)**
    - Eugene's 2013 imported emissions estimate (**1.6 million MT CO_2e**) combined with 2019 upstream energy production emissions (**.3 million MT CO_2e**) and sector-based emissions (**1 million MT CO_2e**) total nearly **2.9 million MT CO_2e**.
- **Fossil Fuel Use**
    - Eugene's 2019 fossil fuel use totals **13.6 million British thermal units** (MMBTU).[4] The largest fossil fuel sources used in the community include gasoline/diesel use (55%) and natural gas (37%). Smaller sources include fossil fuels used to generate electricity (5%) and other fuels, including propane and fuel oil (3%).
    - Eugene's total community fossil fuel use has *decreased* by 6% since 2010.
    - On a per capita basis, fossil fuel use has declined by 14%, while total population has increased by 10%.
- **Emissions increased slightly compared to 2017**
    - Overall emissions increased by about **10,000 MT CO_2e**.
    - Increases occurred in the residential Building sector and the Transpotation sector.
    - Emissions from the Commercial and Industrial Building Sector and from Waste decreased.

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[1] Market-based electricity accounting is used throughout this report unless otherwise noted.

[2] Eugene's sector-based GHG emissions total **1.7 million MT CO_2e** using location-based electricity accounting.

[3] Metric tons of carbon dioxide equivalent (MT CO_2e) is the international standard unit for measuring and reporting GHGs.

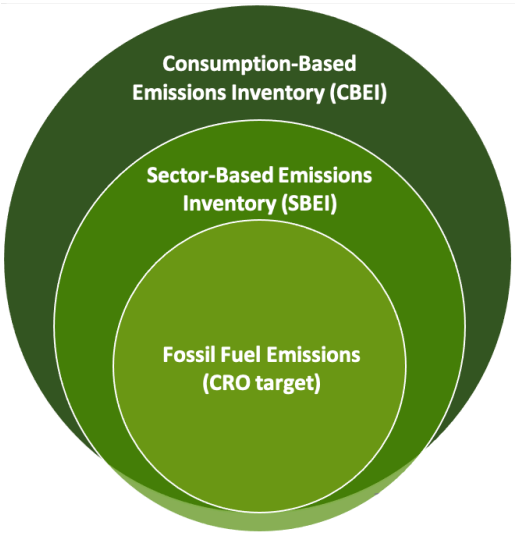
[4] A British thermal unit (BTU) is the amount of heat needed to raise one pound of water one-degree Fahrenheit. Reporting in a common energy unit is required as fossil fuels come in various, incompatible volumetric units (e.g. gallons or cubic feet).

INVENTORY APPROACH

This inventory documents the community of Eugene, Oregon's greenhouse gas emissions (GHGs) for calendar year 2019 with historical inventory years. Inventory results are presented using two types of inventory methodologies: Sector-Based and Consumption-Based.

- ***Sector-based emissions inventories*** (local emissions) include emissions from energy use by homes, businesses, and vehicles as well as emissions from refrigerant use, landfilling solid waste, and wastewater treatment. GHG emissions from **fossil fuels** are the largest component of the community's Sector-based GHG emissions and have 2030 reduction targets in the CRO.
- ***Consumption-based emissions inventories*** include local, sector-based emissions plus emissions that are generated during production and delivery of imported goods, energy and food consumed within the Eugene community, and exclude emissions from local production that are exported.

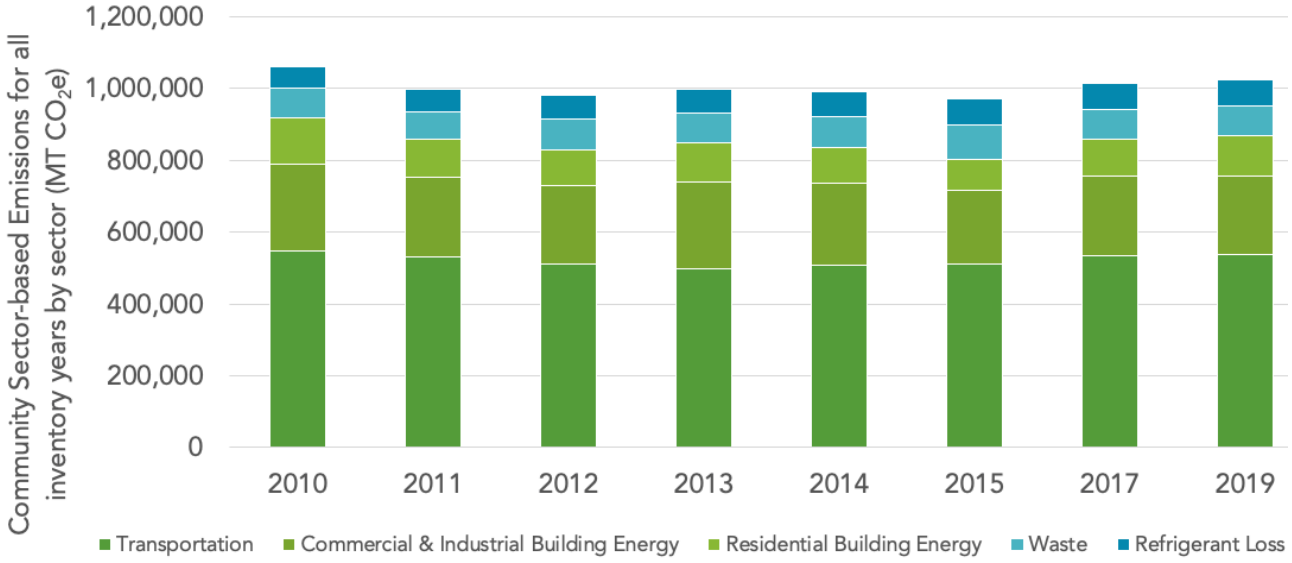
Figure 1: Nested relationship between CRO goals and related inventory work.



TOTAL SECTOR-BASED GREENHOUSE GAS EMISSIONS

In 2019, emissions totaled just over **1 million MT CO_2e**. Transportation fuels caused 53% of emissions, primarily from gasoline use. Commercial & industrial building energy (electricity, natural gas, other fuels) caused 21% of emissions while residential building energy caused 11%. Emissions also include landfilled solid waste (8%) and refrigerant loss (7%). See **table 1** for more details. Between 2010 and 2019, Eugene's GHG emissions decreased by 4%. This reduction from the 2010 baseline was achieved while population increased by 10% over the same period. Per-capita GHGs have reduced by 12%.

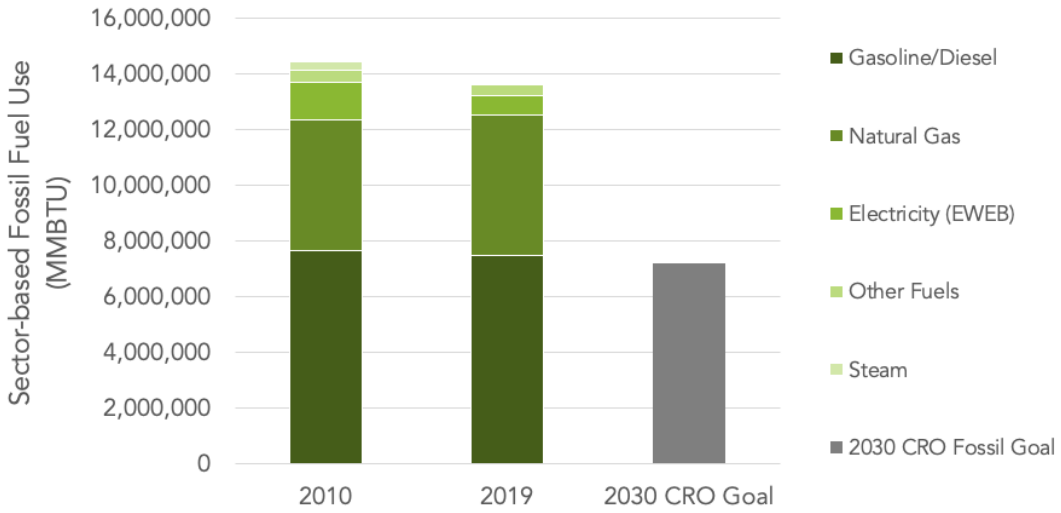
Figure 2: Total sector-based emissions for all inventory years, using market-based accounting.



PROGRESS TOWARDS CRO FOSSIL FUEL TARGET

The Climate Recovery Ordinance No. 20567 (CRO) specifies a community goal of 50% reduction in fossil fuel emissions by 2030 based on a 2010 baseline. Fossil fuel emissions sources include transportation fuels and building energy sources. Between 2010 and 2019, the Eugene community's fossil fuel use has decreased by 6%. This reduction from the 2010 baseline was achieved while population increased by 10% over the same period. Per-capita fossil fuel use has reduced by 14% between 2010 and 2019.

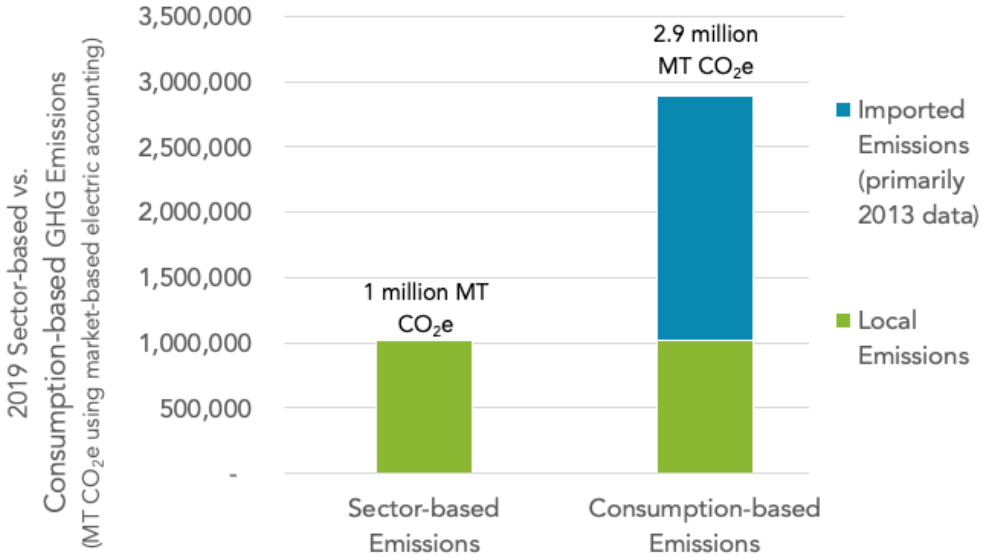
Figure 3: Comparison of 2010 (target baseline) and 2019 fossil fuel use to 2030 CRO target



CONSUMPTION-BASED EMISSIONS

Consumption-based emissions from the production of imported goods, food, energy, and services are more difficult to measure and track, but when accounted for, make up a significant portion of the community's emissions. The two inventory types together offer a more comprehensive view of the Eugene community's GHG emissions. The community has greater control over sector-based emissions sources, as well as better data, which is why this accounting methodology is most often used to set emissions reduction goals. Figure 4 compares community emissions using sector-based and consumption-based GHG accounting methodologies.

Figure 4: 2019 Sector-Based vs. Consumption-Based Emissions.



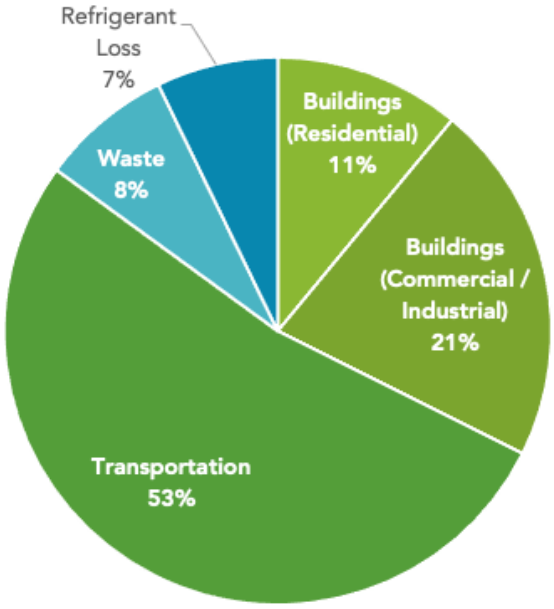
DETAILED INVENTORY RESULTS

Eugene's sector-based emissions inventory (SBEI) totaled about **1 million metric tons** of carbon dioxide equivalent (MT CO_2e)[5] for calendar year 2019. These emissions are summarized on Figure 5 and use market-based electric emissions accounting.

Location-based electricity accounting total nearly **1.7 million MT CO_2e**. *(See page 9 for discussion of electricity-related emissions including location-based and market-based accounting methods).*

Figure 6 shows 2019 sector-based emissions combined with the imported components of consumption-based emissions from the 2013 CBEI inventory.

Figure 5: Eugene 2019 emissions by sector (using market-based electricity accounting)

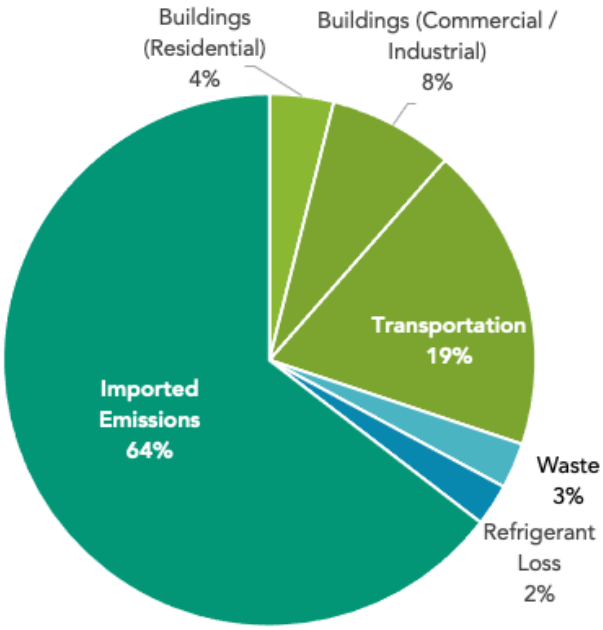


Buildings

Building emissions totaled **331,525 MT CO_2e (32%)**, primarily come from natural gas and electricity use. Electricity use (kilowatt-hours consumed) decreased by 1.3% between 2010 and 2019 despite population growth and emissions decreased by 51% due to an increase in the share of low-carbon intensity electricity production generated or purchased by EWEB.

During this period, total natural gas use and the associated emissions increased by 7%. The residential sector led the increase, which is attributed to population growth and varying winter temperatures.

Figure 6: Eugene 2019 sector-based emissions combined with 2013 imported consumption-based emissions



Transportation

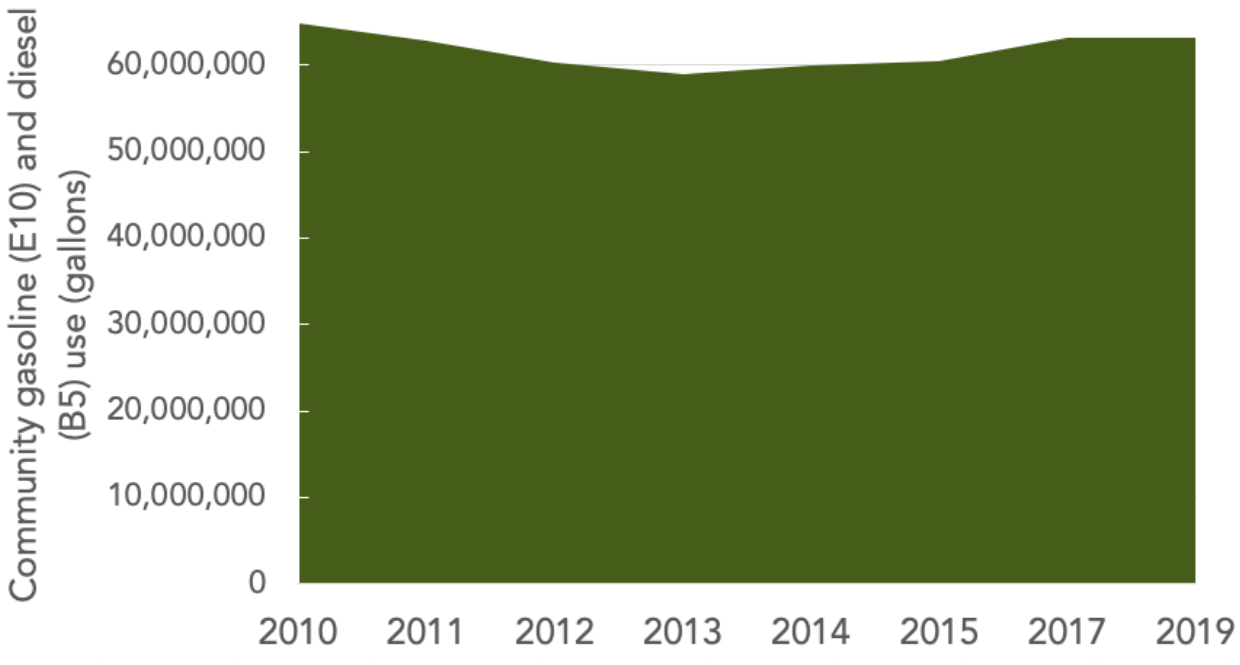
Transportation emissions totaled **538,677 MT CO_2e (53%)** and are primarily from the combustion of gasoline (E10) and diesel (B5) fuels in local, on-road passenger and freight vehicles, as well as off-road equipment.[6] There is also a small but growing amount

[5] Metric tons of carbon dioxide equivalent (MT CO_2e) is the international standard unit for measurement and reporting of greenhouse gas emissions.

[6] Oregon's Renewable Fuel Standard requires that all motor gasoline (with limited exceptions) is E10 (10% ethanol and 90% gasoline). Diesel fuel is required to be B5 (5% biodiesel and 95% diesel).

of emissions from electricity used in electric vehicles. Transportation emissions decreased by 2% between 2010 and 2019. Since 2013, the fuel consumption has shown an increase almost returning to 2010 levels, as shown in Figure 7. Vehicle types, fuel economy, and the generally improving domestic economy all play a role in fuel sales, and show an increasing fuel sales trend rather than decreasing.

Figure 7: Comparison of vehicle fuel use in Eugene for all inventory years.



Other sector-based emissions

Solid waste emissions, as reported by Lane County for Short Mountain Landfill, totaled **79,840 MT CO_2e (8%)**; these emissions decreased by 4% compared to 2010. Refrigerant emissions, calculated for Eugene based on Oregon per capita values, totaled **73,538 MT CO_2e (7%)**; these emissions increased by 21% since 2010.

Eugene Airport

For the first time, specific emissions from jet fuel and aviation gasoline at Eugene Airport were estimated as new data became available. While these emissions are significant at **66,226 MT CO_2e**, GPC protocol guidance does not recommend including these emissions in inventory calculations. Instead, air travel emissions are estimated in consumption-based emissions.

Table 1: Detailed summary of Eugene's 2010–2015, 2017, and 2019 sector-based GHG emissions by sector and energy type. *Note – This table includes emissions using two accounting methods for electricity – Location-based and Market-based. These two methods are described in more detail on page 9. The Sector sub-totals (light green highlighted rows) include market-based emissions for electricity.*

Total Emissions (MT CO2e / year)	2010	2011	2012	2013	2014	2015	2017	2019	Change from 2010
Residential (market-based)	**129,215**	**105,421**	**99,105**	**112,187**	**99,887**	**87,622**	**105,249**	**112,536**	**-13%**
Electricity (Location-Based)	367,777	381,102	285,767	297,476	380,867	370,022	291,271	273,850	-26%
Electricity (Market-Based)	*28,736*	*14,888*	*12,245*	*20,591*	*12,869*	*11,609*	*9,861*	*14,079*	-51%
Natural Gas	70,801	76,473	74,771	78,758	73,234	65,655	85,079	86,192	22%
District Steam	15,143			*Steam plant decommissioned in 2012*					-100%
Other Fuels	14,535	14,060	12,089	12,838	13,784	10,358	10,309	12,265	-16%
Commercial & Industrial (market-based)	**239,389**	**220,608**	**218,805**	**239,915**	**227,710**	**205,883**	**222,263**	**218,989**	**-9%**
Electricity (Location-Based)	553,658	545,969	434,798	433,201	583,601	585,081	433,855	416,933	-25%
Electricity (Market-Based)	*43,259*	*21,329*	*18,631*	*29,986*	*19,896*	*18,356*	*14,688*	*21,436*	-50%
Natural Gas	178,352	185,636	190,546	201,412	198,021	176,958	197,055	180,839	1%
Other Fuels	17,778	13,643	9,628	8,517	9,793	10,569	10,520	16,713	-6%
Transportation (market-based)	**548,606**	**531,317**	**510,887**	**498,191**	**508,032**	**509,499**	**532,685**	**538,677**	**-2%**
Gasoline (E10)	354,773	341,045	326,015	319,368	324,898	339,062	354,493	357,698	1%
Diesel (B5)	193,833	190,272	184,872	178,823	183,134	170,407	178,162	180,914	-7%
Electric Vehicles (Location-Based)				*not calculated*				1,256	n/a
Electric Vehicles (Market-Based)			*not calculated*			30	30	65	n/a
Waste	**83,408**	**79,007**	**87,893**	**82,009**	**85,617**	**94,563**	**80,626**	**79,840**	**-4%**
Landfilled Solid Waste	80,024	75,824	84,252	77,980	82,180	90,860	76,972	76,006	-5%
Wastewater Treatment Process	3,384	3,183	3,641	4,029	3,437	3,703	3,654	3,834	13%
Process & Fugitive Emissions	**60,648**	**62,394**	**64,659**	**66,454**	**69,297**	**73,155**	**72,807**	**73,538**	**21%**
Stationary Refrigerant Loss	24,968	25,682	26,622	27,363	28,522	30,125	29,982	30,232	21%
Transportation Refrigerant Loss	35,680	36,712	38,037	39,091	40,775	43,030	42,825	43,306	21%
Total Emissions (Market-Based)	**1,061,266**	**998,748**	**981,349**	**998,756**	**990,543**	**970,723**	**1,013,630**	**1,023,580**	**-4%**
Total Emissions (Location-Based)	**1,910,706**	**1,889,601**	**1,671,038**	**1,678,856**	**1,922,246**	**1,895,860**	**1,714,207**	**1,680,039**	**-12%**
Per Capita Emissions (Market-Based)	**6.8**	**6.4**	**6.2**	**6.3**	**6.2**	**5.9**	**6.0**	**6.0**	**-12%**

*Note: Refrigerant emissions are scaled per capita based on State of Oregon GHG reporting. The most recent Oregon data available, at the time of conducting Eugene's community inventory, was for calendar year 2017.

Table 2: Detailed summary Eugene's 2010–2015, 2017, and 2019 sector-based fossil fuel use by sector and energy type. *Note – This table only includes Market-based accounting. This approach was selected by the City as the preferred approach for accounting towards the CRO fossil fuel target, per guidance from Greenhouse Gas Protocol - Scope 2 Guidance. The guidance states that market-based accounting is the preferred method for organizational goal-related tracking.*

Total Emissions (MMBTU / year)	2010	2011	2012	2013	2014	2015	2017	2019	Change since 2010
Residential	**2,357,920**	**1,919,902**	**1,808,788**	**2,053,514**	**1,817,242**	**1,551,371**	**1,933,416**	**2,067,581**	**-12%**
Electricity (Location-Based)				***Market-based accounting used for CRO fossil fuel target***					
Electricity (Market-Based)	*541,461*	*280,539*	*230,733*	*387,993*	*242,481*	*168,269*	*185,810*	*265,298*	-51%
Natural Gas	1,331,175	1,437,831	1,405,819	1,480,797	1,376,936	1,234,425	1,599,635	1,624,306	22%
District Steam	277,449				*Steam plant decommissioned in 2014*				-100%
Other Fuels	207,835	201,532	172,236	184,724	197,825	148,677	147,971	177,977	-14%
Commercial & Industrial	**4,412,058**	**4,081,738**	**4,070,109**	**4,472,345**	**4,231,349**	**3,740,772**	**4,128,641**	**4,057,246**	**-8%**
Electricity (Location-Based)				***Market-based accounting used for CRO fossil fuel target***					
Electricity (Market-Based)	*815,125*	*401,902*	*351,063*	*565,018*	*371,552*	*266,067*	*276,768*	*403,912*	-50%
Natural Gas	3,353,328	3,490,286	3,582,606	3,786,892	3,723,150	3,327,114	3,704,983	3,407,959	2%
Other Fuels	243,605	189,550	136,441	120,436	136,646	147,591	146,890	245,375	1%
Transportation	**7,672,560**	**7,428,954**	**7,141,943**	**6,965,498**	**7,102,514**	**7,132,043**	**7,456,630**	**7,512,378**	**-2%**
Gasoline (E10)	5,050,874	4,855,425	4,641,448	4,546,816	4,625,536	4,827,199	5,046,890	5,073,781	0%
Diesel (B5)	2,621,687	2,573,529	2,500,495	2,418,682	2,476,977	2,304,844	2,409,740	2,437,373	-7%
Electric Vehicles				*Previously part of stationary energy*				*1,224*	n/a
Waste	***Does not include fossil fuel use***								
Landfilled Solid Waste									
Wastewater Treatment Process									
Process & Fugitive Emissions	***Does not include fossil fuel use***								
Stationary Refrigerant Loss									
Transportation Refrigerant Loss									
Total Fossil Fuel Use (Market-Based)	**14,442,538**	**13,430,594**	**13,020,841**	**13,491,356**	**13,151,104**	**12,424,187**	**13,518,686**	**13,637,206**	**-6%**
Per Capita Fossil Fuel Use (Market-Based)	**92.4**	**85.5**	**82.2**	**84.5**	**81.8**	**76.0**	**80.6**	**79.7**	**-14%**

*Note: Fossil fuels use for market-based electricity are calculated using a natural gas electricity generation benchmark. In other words, fossil fuels use from EWEB's electricity is assumed to be 100% from electricity generated by natural gas. Fossil fuel use for EWEB electricity is calculated using EWEB-specific fossil fuel emissions factors as provided by Oregon Department of Environmental Quality (kg CO_2e / MWh); heat rates for natural gas generated electricity (BTU / kWh) from the U.S. Energy Information Administration (https://www.eia.gov/electricity/annual/html/epa_08_01.html); and natural gas emissions factor (kg CO_2 / MMBTU) from the U.S. Energy Information Administration (https://www.eia.gov/electricity/annual/html/epa_a_03.html).

ELECTRICITY ACCOUNTING

Electricity emissions can be calculated using two methods – Location-Based and Market-Based accounting[7] – based on Greenhouse Gas Protocol's *Scope 2 Guidance*. The *Global Community GHG Protocol* requires users to report using the location-based method, which uses an average emissions factor for the Northwest's regional electricity grid to calculate emissions (i.e. Northwest Power Pool). The Guidance suggests conducting a sensitivity analysis using the market-based method. This accounting method uses EWEB's utility-specific carbon intensity[8], based on its owned and contracted generation resources, to calculate emissions. Eugene's market-based emissions are 19 times less carbon intensive than the regional average, or about 5% of the Northwest Regional Power Pool. This is because EWEB, as a public utility, predominantly contracts with Bonneville Power Administration (BPA) whose generation supply is largely from low-carbon, hydroelectric and nuclear resources, and EWEB's owned, low-carbon resources which include hydro and wind.

Scope 2 protocol guidance describes the Location-based method as a representation of the average GHG impacts associated with electricity use within a defined geographic territory and time period. Alternatively, the Market-based method represents electricity that has been purposefully chosen via the GHG impacts associated with EWEB's supply contracts that serve the community. Both methods are useful for different purposes; together, they provide a fuller documentation and assessment of risks, opportunities, and changes to emissions from electricity supply over time. See Greenhouse Gas Protocol's *Scope 2 Guidance* for details.

INVENTORY METHODOLOGY

The Eugene sector-based inventory follows Greenhouse Gas Protocol's *Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories.* ICLEI'S web-based *ClearPath* Community-Scale Emissions Management Software was used to calculate all greenhouse gas (GHG) emissions for the Eugene's Community Inventories for 2010–2015, 2017, and 2019. Data and calculation files are cataloged in a corresponding audit trail organized by inventory year.

The Eugene consumption-based inventory incorporates Eugene's sector-based emissions with imported emissions from a consumption-based emissions inventory model that was developed by Stockholm Environment Institute for Oregon Department of Environmental Quality (ODEQ) to support completion of the State of Oregon's 2005 Consumption-Based Inventory. ODEQ staff used the 2010 version of the Oregon model to estimate the Eugene community's 2013 consumption-based emissions. The City plans to work with ODEQ in the future to update Eugene's CBEI using newer data.

[7] For details about these two accounting methodologies see Greenhouse Gas Protocol's Scope 2 Guidance.
[8] Utility-specific factors are provided by Oregon Department of Environmental Quality (ODEQ) based on EWEB regulatory reporting.

All community GHG emissions presented in this report are represented in metric tons of carbon dioxide equivalent (MT CO_2e). Quantities of individual GHGs are accounted for in Good Company's G3C Community carbon calculator tool and include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), CFCs, PFCs, and sulfur hexafluoride (SF_6) as applicable per the Kyoto Protocol. All GHG calculations use the global warming potentials (GWP) as defined in the International Panel on Climate Change's 5th Assessment Report (IPCC AR5).